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EXAMINER

WANG, EUGENIA

ART UNIT

PAPER NUMBER

1795

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/053,085	<b>Applicant(s)</b> GORTE ET AL.	
	<b>Examiner</b> EUGENIA WANG	<b>Art Unit</b> 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 06 August 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 2-19,21-30,55,56,58,60 and 62-67 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 2-19,21-30,55,56,58,60 and 62-67 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Response to Amendment***

1. In response to the amendment received August 6, 2008:
  - a. Claims 2-19, 21-30, 55, 56, 58, 60, and 62-70 are pending.
  - b. The previous rejection of record has been withdrawn. A new rejection has been applied, as necessitated by the amendment.

### ***Continued Examination Under 37 CFR 1.114***

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on August 6, 2008 has been entered.

### ***Specification***

3. The abstract of the disclosure is objected to because it is more than one paragraph and contains more than 150 words. Correction is required. See MPEP § 608.01(b).

### ***Claim Objections***

4. Claims 11-14 are objected to because of the following informalities: they seem to read "pprn" rather than "ppm" in line 2. Applicant is advised to double check that the abbreviation for part per million (ppm) is correct, as "r-n" may appear to look like an "m." Appropriate correction is required.

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***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 2, 9, 10-12, 15, 16, 18, 21, 27, 30, 62, 63, 65, and 66 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5445903 (Cable '903) in view of US

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4812329 (Isenberg). (NOTE: The current Cable reference referred to is different than that previously relied upon.)

As to claims 62, 63, 65, and 66, Cable '903 teach of a solid oxide fuel cell (col. 3, lines 49-52). The fuel cell has a cathode [5], an anode [4], an electrolyte, oxygen, and fuel (col. 3, lines 49-62). (As seen in Table II and col. 11, lines 41-50, air and hydrogen are fed to the electrode (oxygen (cathode) and fuel (anode), respectively.) The electrolyte is ion transferring and is made of yttria stabilized zirconia (col. 4, lines 57-65). It is note that yttria stabilized zirconia is inherently an electric insulator.

Where applicant claims a composition in terms of a function, property or characteristic and the composition of the prior art is the same as that of the claim but the function is not explicitly disclosed by the reference, the examiner may make a rejection under both 35 U.S.C. 102 and 103, expressed as a 102/103 rejection.

The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. In re Rijckaert, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993).

"In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." Ex parte Levy, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990)

In the case of the instant application the basis for expectation of inherency is the fact that it is the same material as Applicant uses and thus must have the same characteristic of being electronically insulating (see spec p10 line 16 to p 11 line 1).

The Examiner requires applicant to provide that the prior art products do not necessarily or inherently possess the characteristics of his [or her] claimed product.

Whether the rejection is based on inherency' under 35 U.S.C. 102, on prima facie obviousness' under 35 U.S.C. 103, jointly or alternatively, the burden of proof is the same...[footnote omitted]." The burden of proof is similar to that required with respect to product-by-process claims. In re Fitzgerald, 619 F.2d 67, 70, 205 USPQ 594, 596 (CCPA 1980) (quoting In re Best, 562 F.2d 1252, 1255, 195 USPQ 430, 433-34 (CCPA 1977)).

The anode [4] is porous and has a metal such as nickel or cobalt blended with an oxide power such as zirconia, ceria, yttria, or doped ceria (ceramics) (col. 5, lines 23-26). Therefore, Cable '903 teaches a fuel electrode that does not have nickel in it\*. (Please see \* for an alternate interpretation.)

As seen in fig. 1, the solid electrolyte [6] and the anode [4], wherein essentially the entirety of the physical contact between the solid electrolyte and the porous anode is between the electrolyte and the porous ceramic of the composite anode.

\*Alternately it can be interpreted that since Cable '903 does not specifically teach an example of a solid oxide fuel cell, wherein there is no nickel in the anode (as example A in col. 10 uses nickel as the metallic powder). However, in this case, the use of other metallic powders besides nickel would have been obvious to one of ordinary skill in the art, as Cable '903 teaches of the use of cobalt instead of nickel (col. 5, lines 23-26). Therefore nickel and cobalt are art recognized equivalents, and it would have been obvious to one of ordinary skill in the art at the time the invention was made to

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substitute cobalt for nickel with the predictable result of it functioning in a solid oxide fuel cell anode as a metallic powder used in the anode.

Cable '903 does not teach of (a) having ceria deposited in the pores of the anode and (b) using a fuel comprising a sulfur-containing hydrocarbon having a sulfur content from about 1-5000 ppm.

As to (a), Isenberg teaches that the fuel electrode (anode) is porous and is impregnated with cerium nitrate, which results in a porous fuel electrode with ceria ( $(\text{CeO}_2)_{0.8}(\text{La}_2\text{O})_{0.2}$ ) impregnated in the porous electrode (col. 6, lines 12-43). The motivation for using ceria based outer coatings (made by such impregnation, resulting in ceria in the pores) is that ceria doping results in proved sulfur tolerance (col. 1, lines 55-68; col. 2, lines 1-27, 54-56; col. 5, lines 3-9; col. 7, lines 1-20 fig. 6). Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to impregnate the fuel electrode of Cable '903 et al. with ceria (which results with ceria in the pores of the anode) in order to improve sulfur tolerance within the fuel cell.

As to (b), it is first noted that Cable '903 embodies a hydrogen fuel (see table II). Isenberg embodies a hydrogen or CO fuel with 50 ppm hydrogen sulfide in it (col. 2, lines 60-67; col. 7, lines 1-20). It is noted that although  $\text{H}_2$  and CO are embodied (not a hydrocarbon) with 50 ppm hydrogen sulfide in it, other fuels, such as methane (a hydrocarbon) are embodied as well (col. 2, lines 60-67; col. 7, lines 1-20). Accordingly, Isenberg obviates the use of a 50 ppm hydrogen sulfide in a hydrocarbon fuel to one of ordinary skill in the art, since Isenberg teaches other fuels that can be used instead of

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H<sub>2</sub> and CO, namely methane (col. 2, lines 60-67). Therefore H<sub>2</sub>, CO, and methane are art recognized equivalents, and it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute any of the art recognized equivalents for fuel with the predictable result of it functioning in a solid oxide fuel cell. Such a teaching applies to Cable '903, as Isenberg obviates the fact that using a fuel (hydrogen, CO, and methane) with a 50 ppm sulfur impurity would still result in an operating fuel cell, if ceria were present in the pores. Accordingly, the combination of Cable '903 and Isenberg with respect to (a) (having ceria deposited in the pores) would obviate the use of such a fuel (hydrocarbon fuel with a 50 ppm sulfur impurity), since such a substitution of such a fuel would result in the predictable result of function as a fuel in a solid oxide fuel cell. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to use a hydrocarbon with a 50 ppm sulfur impurity, as Isenberg teaches that hydrogen and methane are art recognized equivalents for fuel, wherein a ceria doped anode would be sulfur tolerant up to at least 50 ppm, and thus the use of such a fuel in the obviated structure of Cable '903 and Isenberg would obviate using such a fuel, since it would have yielded in the predictable result of acting as a functioning fuel in a solid oxide fuel cell. (Note: 50 ppm of hydrogen sulfide is taken to be approximately 50 ppm sulfur, as the weight of the hydrogen portion in hydrogen sulfide is small and negligible.)

It is noted that the fuel cell of the combined teaching of Cable '903 and Isenberg inherently has a method of operation to provide electricity using the apparatus, as



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discussed above (as applied to claims 63 and 66), wherein the reactants are brought in contact with the fuel cell.

As to claims 2, 9, 21, and 27, the combination of Cable '903 and Isenberg teach the limitation, as Isenberg is relied upon to teach the use of methane (a specific type of petroleum distillate) used as fuel in a solid oxide fuel cell (col. 2, lines 64-67).

As to claims 10-12 and 30, the combination of Cable '903 and Isenberg teach the limitation, as Isenberg embodies a fuel with 50 ppm hydrogen sulfide in it (col. 2, lines 64-67; col. 7, lines 1-20). Although the example uses H<sub>2</sub> and CO as the fuel (not a hydrocarbon) with 50 ppm hydrogen sulfide in it, other fuels, such as methane (a hydrocarbon) are embodied as well (col. 2, lines 60-67; col. 7, lines 1-20). Therefore Isenberg does teach or at the very least obviate of a hydrocarbon with hydrogen sulfide (sulfur impurity) as well. (Please see part (b) in the rejection of claims 62, 63, 65, and 66 for a full explanation as to how Isenberg applies to such a teaching.) (Note: 50 ppm of hydrogen sulfide is taken to be approximately 50 ppm sulfur, as the weight of the hydrogen portion in hydrogen sulfide is small and negligible.)

As to claim 15, Cable '903's electrolyte conducts ionized oxygen (oxide ion) (col. 4, lines 57-65).

As to claims 16 and 18, Cable '903's electrolyte is yttria stabilized zirconia (col. 4, lines 57-65).

6. Claims 3, 5-8, 22, 24-26, 28, and 29 rejected under 35 U.S.C. 103(a) as being unpatentable over Cable '903 in view of Isenberg, as applied to claims 62, 2, 63, and 21, in further view US 6423896 (Keegan).

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As to claims 3, 5, 6, 22, 24, 25, and 26, the combination of Cable '903 and Isenberg does not teach the use of a petroleum distillate fuel of gasoline, diesel oil, naphtha, JP-4, JP-5, kerosene, motor oil, natural gas, fuel oil, and mixtures thereof (as required by claims 3, 5, 6, 22, 24, 25, and 26).

Keegan teaches a list of possible fuels used in a solid oxide fuel cell system (col. 1, lines 62-64). These fuels include methane (the same fuel taught by Isenberg) as well as diesel (as applied to claims 3, 22, and 26), kerosene (as applied to claims 3, 5, 22, and 24), and gasoline (as applied to claims 3, 6, 22, and 25) (col. 2, lines 43-65). Accordingly, methane, diesel, gasoline, and kerosene are all art recognized equivalents for methane for their use as fuels in solid oxide fuel cells. Furthermore, it is particularly pointed out that the combination of the conventional hydrocarbon fuels can also be combined with the simpler fuels (such as methane) (col. 2, lines 44-65). Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to use diesel, kerosene, gasoline, or combinations of the aforementioned with methane as fuel (instead of methane), since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416. Furthermore, the replacement of art recognized equivalents with one another would result in the predictable result of acting in the same manner (acting as fuel).

As to claims 7, 8, 28, and 29, the combination of Cable '903 and Isenberg does not teach the use of alcohols (as required by claims 7 and 28), namely methanol, ethanol, and mixtures thereof (as required by claims 8 and 29) as fuel.

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Keegan teaches a list of possible fuels used in a solid oxide fuel cell system (col. 1, lines 62-64). These fuels include methane (embodied by Isenberg), ethanol and methanol (col. 2, lines 43-65). Accordingly, methanol and ethanol are art recognized equivalents for methane for their use as fuels in solid oxide fuel cells. Furthermore, it is particularly pointed out that the combination of the alcohol fuels (methanol and ethanol) can also be combined with the simpler fuels (such as methane) (col. 2, lines 44-65). Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to use ethanol, methanol, or either of the aforementioned with methane as fuel (instead of methane), since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416. Furthermore, the replacement of art recognized equivalents with one another would result in the predictable result of acting in the same manner (acting as fuel).

7. Claims 4, 13, 14, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cable '903 in view of Isenberg, as applied to claims 62, 2, 10-12, 63, and 21, in view of Keegan, as applied to claims 2 and 22, in further view of US 6221280 (Anumakonda et al.).

As to claims 4 and 23, the combination of Cable '903, Isenberg and Keegan do not teach the use of JP-4, JP-5, JP-8, or mixtures thereof as the fuel.

However, Anumakonda et al. teach the use of heavier fuels to be used in solid oxide fuel cells, such as JP-8, JP-4, and JP-5 (abs.; col. 1, lines 10-16; col. 2, lines 38-44; col. 4, lines 5-15). It would have been obvious to one having ordinary skill in the art

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at the time the invention was made to use heavier fuels (JP-8, JP-4, or JP-5) in a solid oxide fuel cell, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Note: The claim language for independent claims 62 and 63 only state that the sulfur-containing hydrocarbon fuel “does not have to undergo prior treatment.” This statement does not positively limit that the sulfur-containing hydrocarbon fuel does not or cannot undergo prior treatment. Such an interpretation was applied as to the rejection above. For an alternate interpretation, see \*\*\*, below.

\*\*\* Alternately, it would have been obvious to use heavier fuels (with higher sulfur content - up to 0.3 wt% (3000 ppm) but typically between 0.05- 0.07 (500-700 ppm) (col. 2, lines 38-44)). The motivation for using fuels with jet fuels (JP-4, JP-5, JP-8) with higher sulfur content would lie in the fact that Isenberg teaches that ceria doped anodes can withstand more sulfur impurities. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made, as one of ordinary skill in the art would have been able to appreciate using JP-8, JP-4, and JP-5 in a solid oxide fuel cell without treatment with the predictable result of the fuel cell functioning in the same manner, since Isenberg teaches that ceria doped anodes are more sulfur tolerant.

As to claims 13 and 14, the combination of Cable '903, Isenberg, and Keegan do not teach the use of a sulfur-containing hydrocarbon fuel with a sulfur content from

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about 100 -1000 ppm (as required by claim 13) or 250-1000 ppm (as required by claim 14).

However, Anumakonda et al. teach the use of heavier fuels to be used in solid oxide fuel cells, such as JP-8, JP-4, and JP-5, wherein the aforementioned fuels have a sulfur content of about 0.05 to 0.07 wt.% (500-700 ppm) (abs.; col. 1, lines 10-16; col. 2, lines 38-44).

Motivation for using JP-8, JP-4, and JP-5 has been discussed in the rejection of claims 4 and 23 but are reiterated herein for clarity's sake.

Anumakonda et al. teach the use of heavier fuels to be used in solid oxide fuel cells, such as JP-8, JP-4, and JP-5 (wherein the aforementioned fuels have a sulfur content of about 0.05 to 0.07 wt.% (500-700 ppm)) (abs.; col. 1, lines 10-16; col. 2, lines 38-44). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use heavier fuels (JP-8, JP-4, or JP-5) in a solid oxide fuel cell, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Note: The claim language for independent claims 62 and 63 only state that the sulfur-containing hydrocarbon fuel "does not have to undergo prior treatment." This statement does not positively limit that the sulfur-containing hydrocarbon fuel does not or cannot undergo prior treatment. Such an interpretation was applied as to the rejection above. For an alternate interpretation, see \*\*\*, below.

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\*\*\* Alternately, it would have been obvious to use heavier fuels (with higher sulfur content - up to 0.3 wt% (3000 ppm) but typically between 0.05- 0.07 (500-700 ppm) (col. 2, lines 38-44)). The motivation for using fuels with jet fuels (JP-4, JP-5, JP-8) with higher sulfur content would lie in the fact that Isenberg teaches that ceria doped anodes can withstand more sulfur impurities. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made, as one of ordinary skill in the art would have been able to appreciate using JP-8, JP-4, and JP-5 in a solid oxide fuel cell without treatment with the predictable result of the fuel cell functioning in the same manner, since Isenberg teaches that ceria doped anodes are more sulfur tolerant.

8. Claims 17 and 19 rejected under 35 U.S.C. 103(a) as being unpatentable over Cable '903 in view of Isenberg, as applied to claims 62, 15, and 16, in view of US 6017647 (Wallin).

As to claims 17 and 19, Cable '903 teaches the use of doped zirconia and doped ceria for the oxide ion conducting electrolyte (col. 4, lines 57-65). Cable '903 does not teach that the electrolyte is gadolinium doped ceria, samarium-doped ceria, yttria-doped ceria, and mixtures thereof (as required by claim 17) or scandium-doped zirconia (as required by claim 19).

Wallin teach a solid oxide fuel cell, wherein the ionically conductive electrolyte includes yttria-stabilized zirconia (also taught by Isenberg), scandium-doped zirconia (as applied to claim 19), gadolinium-doped ceria (as applied to claim 17) (abs; col. 4, lines 49-59). Therefore, Wallin shows that scandium-doped zirconia, gadolinium-doped

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ceria, and yttria-stabilized zirconia are art recognized equivalents. Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to use either gadolinium-doped ceria or scandium-doped zirconia as the electrolyte, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416. Furthermore, the replacement of art recognized equivalents with one another would result in the predictable result of acting in the same manner (oxide ion conducting).

9. Claims 55, 56, 58, and 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cable '903 in view of Isenberg, as applied to claims 62, 63, 65, and 66, in further view of US 5589285 (Cable '285).

As to claims 55, 56, 58, and 60, the combination of Cable '903 and Isenberg does not teach the addition of copper into the pores of the anode.

Cable '285 teaches of doping an anode with sulfur-resistance ceria, wherein an electronically conducting phase, such as copper, is added (col. 10, lines 17-31). The motivation for wanting to include copper in the ceria dopant (which would then impregnate the anode) would be to increase the electronic conductivity throughout the fuel cell and thus improve performance. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to add electronically conductive copper to ceria (as taught by Cable '285), wherein the ceria mixture is used to impregnate the anode for sulfur tolerance (as taught by Isenberg) in order to facilitate electronic conductivity and improve fuel cell operation.

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10. Claims 64 and 67 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cable '903 in view of Isenberg and Cable '285.

As to claims 64 and 67, Cable '903 teach of a solid oxide fuel cell (col. 3, lines 49-52). The fuel cell has a cathode [5], an anode [4], an electrolyte, oxygen, and fuel (col. 3, lines 49-62). (As seen in Table II and col. 11, lines 41-50, air and hydrogen are fed to the electrode (oxygen (cathode) and fuel (anode), respectively.) The electrolyte is ion transferring and is made of yttria stabilized zirconia (col. 4, lines 57-65). It is note that yttria stabilized zirconia is inherently an electric insulator.

Where applicant claims a composition in terms of a function, property or characteristic and the composition of the prior art is the same as that of the claim but the function is not explicitly disclosed by the reference, the examiner may make a rejection under both 35 U.S.C. 102 and 103, expressed as a 102/103 rejection.

The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. In re Rijckaert, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993).

"In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." Ex parte Levy, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990)

In the case of the instant application the basis for expectation of inherency is the fact that it is the same material as Applicant uses and thus must have the same characteristic of being electronically insulating (see spec p10 line 16 to p 11 line 1).



The Examiner requires applicant to provide that the prior art products do not necessarily or inherently possess the characteristics of his [or her] claimed product.

Whether the rejection is based on inherency' under 35 U.S.C. 102, on prima facie obviousness' under 35 U.S.C. 103, jointly or alternatively, the burden of proof is the same...[footnote omitted]." The burden of proof is similar to that required with respect to product-by-process claims. In re Fitzgerald, 619 F.2d 67, 70, 205 USPQ 594, 596 (CCPA 1980) (quoting In re Best, 562 F.2d 1252, 1255, 195 USPQ 430, 433-34 (CCPA 1977)).

The anode [4] is porous and has a metal such as nickel or cobalt blended with an oxide power such as zirconia, ceria, yttria, or doped ceria (ceramics) (col. 5, lines 23-26). Therefore, Cable '903 teaches a fuel electrode that does not have nickel in it\*. (Please see \* for an alternate interpretation.)

As seen in fig. 1, the solid electrolyte [6] and the anode [4], wherein essentially the entirety of the physical contact between the solid electrolyte and the porous anode is between the electrolyte and the porous ceramic of the composite anode.

\*Alternately it can be interpreted that since Cable '903 does not specifically teach an example of a solid oxide fuel cell, wherein there is no nickel in the anode (as example A in col. 10 uses nickel as the metallic powder). However, in this case, the use of other metallic powders besides nickel would have been obvious to one of ordinary skill in the art, as Cable '903 teaches of the use of cobalt instead of nickel (col. 5, lines 23-26). Therefore nickel and cobalt are art recognized equivalents, and it would have been obvious to one of ordinary skill in the art at the time the invention was made to

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substitute cobalt for nickel with the predictable result of it functioning in a solid oxide fuel cell anode as a metallic powder used in the anode.

Cable '903 does not teach of (a) having ceria deposited in the pores of the anode, (b) using a fuel comprising a sulfur-containing hydrocarbon having a sulfur content from about 1-5000 ppm, or (c) that copper is deposited in the pores of the anode.

As to (a), Isenberg teaches that the fuel electrode (anode) is porous and is impregnated with cerium nitrate, which results in a porous fuel electrode with ceria ((CeO<sub>2</sub>)<sub>0.8</sub>(La<sub>2</sub>O)<sub>0.2</sub>) impregnated in the porous electrode (col. 6, lines 12-43). The motivation for using ceria based outer coatings (made by such impregnation, resulting in ceria in the pores) is that ceria doping results in proved sulfur tolerance (col. 1, lines 55-68; col. 2, lines 1-27, 54-56; col. 5, lines 3-9; col. 7, lines 1-20 fig. 6). Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to impregnate the fuel electrode of Cable '903 et al. with ceria (which results with ceria in the pores of the anode) in order to improve sulfur tolerance within the fuel cell.

As to (b), it is first noted that Cable '903 embodies a hydrogen fuel (see table II).

Isenberg embodies a hydrogen or CO fuel with 50 ppm hydrogen sulfide in it (col. 2, lines 60-67; col. 7, lines 1-20). It is noted that although H<sub>2</sub> and CO are embodied (not a hydrocarbon) with 50 ppm hydrogen sulfide in it, other fuels, such as methane (a hydrocarbon) are embodied as well (col. 2, lines 60-67; col. 7, lines 1-20). Accordingly, Isenberg obviates the use of a 50 ppm hydrogen sulfide in a hydrocarbon fuel to one of

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ordinary skill in the art, since Isenberg teaches other fuels that can be used instead of  $H_2$  and CO, namely methane (col. 2, lines 60-67). Therefore  $H_2$ , CO, and methane are art recognized equivalents, and it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute any of the art recognized equivalents for fuel with the predictable result of it functioning in a solid oxide fuel cell. Such a teaching applies to Cable '903, as Isenberg obviates the fact that using a fuel (hydrogen, CO, and methane) with a 50 ppm sulfur impurity would still result in an operating fuel cell, if ceria were present in the pores. Accordingly, the combination of Cable '903 and Isenberg with respect to (a) (having ceria deposited in the pores) would obviate the use of such a fuel (hydrocarbon fuel with a 50 ppm sulfur impurity), since such a substitution of such a fuel would result in the predictable result of function as a fuel in a solid oxide fuel cell. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to use a hydrocarbon with a 50 ppm sulfur impurity, as Isenberg teaches that hydrogen and methane are art recognized equivalents for fuel, wherein a ceria doped anode would be sulfur tolerant up to at least 50 ppm, and thus the use of such a fuel in the obviated structure of Cable '903 and Isenberg would obviate using such a fuel, since it would have yielded in the predictable result of acting as a functioning fuel in a solid oxide fuel cell. (Note: 50 ppm of hydrogen sulfide is taken to be approximately 50 ppm sulfur, as the weight of the hydrogen portion in hydrogen sulfide is small and negligible.)

As to (c), Cable '285 teaches doping an anode with sulfur-resistance ceria, wherein an electronically conducting phase, such as copper, is added (col. 10, lines 17-

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31). The motivation for wanting to include copper in the ceria dopant (which would then impregnate the anode) would be to increase the electronic conductivity throughout the fuel cell and thus improve performance. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to add electronically conductive copper to ceria (as taught by Cable '285.), wherein the ceria mixture is used to impregnate the anode for sulfur tolerance (as taught by Isenberg) in order to facilitate electronic conductivity and improve fuel cell operation.

(Note: Although claim 64 includes the claim language that a copper salt is used to deposit copper into the pores of the anode, this is product by process limitation, wherein the product of the combination of Cable '903, Isenberg, Cable '285 would teach of copper in the pores of the anode, thus being the same as the claimed invention. Process limitations are not given weight with regards to the product as long as the product is the same of that of the claimed invention.

“[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.” In re Thorpe, 777 F.2d, 698, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

“The Patent Office bears a lesser burden of proof in making out a case of prima facie obviousness for product-by-process claims because of their peculiar nature” than when a product is claimed in the conventional fashion. In re Fessmann, 489 F.2d 742,

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744, 180 USPQ 324, 326 (CCPA 1974). Once the Examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product. In re Marosi, 710 F.2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983). Ex parte Gray, 10 USPQ2d 1922 (Bd. Pat. App. & Inter. 1989). See MPEP section 2113.)

### ***Response to Arguments***

11. Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection.

Applicant argues that Isenberg does not teach that the porous anode layer and solid electrolyte along an essentially continuous interface.

Examiner submits that all arguments directed towards Isenberg as a primary reference is moot, as Cable '903 is relied upon as the primary reference, wherein such a physical contact between the electrolyte [6] and anode [4] can be seen in fig. 1 of Cable '903.

Applicant argues that the use of Keegan, Anumakonda, Walling, and Cable '285 fail to cure the deficiencies of Isenberg.

Again, such an argument is moot, as the independent claim is now rejected under Cable '903 in view of Isenberg, wherein the combination teaches the claimed invention of claims 62, 63, 65, and 66. Since Applicant only argues that the prior art used to obviate the rejected claims do not cure the deficiencies of Isenberg (previously

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relied upon as the primary reference) and does not argue how the combination is not proper, Examiner maintains the obviousness rejections.

With respect to claims 64 and 67, Applicant argues that Cable '285 is not combinable with Isenberg, because Cable explicitly teaches of not bonding the electronic conductors (metals) with the electrolyte (wherein Isenberg et al. teaches that the conductive particles are bonded to the electrolyte) and thus such combination would change the references' principle of operation.

Examiner respectfully disagrees, and further discusses reasons for such in two points below.

Point 1: Within the current rejection, Isenberg is only being relied upon to provide ceria into the pores for sulfur tolerance purposes. Cable '903 is relied upon as the primary reference wherein, as seen in fig. 1, the porous ceramic anode [4] is physically next to the electrolyte [6]. Furthermore, since electronically conducting particles are only optional (i.e. are not necessarily present within the anode) (col. 5, lines 23-36), there would be no bonding between the electronic conductors (metals) and electrolyte, which Cable '285 criticizes. Accordingly, such an argument with respect to Isenberg is irrelevant, as the new primary reference, Cable '903 does not have the bonding of the conductive particles as Isenberg does.

Point 2: Just because the interfaces taught by Cable '285 and Isenberg are different does not mean that they are not combinable. Cable's criticism of the metal/electrolyte interface is due thermal expansion mismatch (col. 1, lines 55-66). However, the portion relied upon in Cable '285 has to do with sulfur tolerance, as is the portion that is relied

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upon in Isenberg. Accordingly, both are used for the same reason (sulfur tolerance), and accordingly can be combined with respect to such teaching. As previously stated, Isenberg uses ceria, and Cable et al. uses ceria and copper, wherein copper would help facilitate electronic conductivity (as set forth in the rejection in section 10). Accordingly, although the electrolyte/anode interface is different in Isenberg and Cable '285, both pieces deal with sulfur tolerance. Since both similarly deal with sulfur tolerance, the reliance on both teachings with respect to sulfur tolerance are combinable on this front, as sulfur tolerance is what the references' principle of operation is centered around. Again, as Cable '903 is relied upon for the primary reference, such arguments with respect to the anode/electrolyte interface of Isenberg vs Cable '285 are moot, as Cable '903's anode does not necessarily have such conductive metal particles. For the reasons set forth, Examiner's position is maintained.

Applicant argues that even if combinable, the combination of Isenberg and Cable '285 would not teach physical contact between the porous anode layer and the electrolyte.

Examiner respectfully disagrees and submits that Cable '903, now relied upon as the primary reference, show such a physical contact between the electrolyte [6] and anode [4] (fig. 1).

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to EUGENIA WANG whose telephone number is (571)272-4942. The examiner can normally be reached on 7 - 4:30 Mon. - Thurs., EST.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/Gregg Cantelmo/  
Primary Examiner, Art Unit 1795

for

/E. W./  
Examiner, Art Unit 1795